

Associations of employment factors with cardiovascular disease in a national sample of U.S. firefighters: findings from the National Health Interview Survey

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Abstract

Background: We explored whether employment factors were associated with prevalent cardiovascular disease (CVD) in a nationally representative sample of U.S. firefighters.

Methods: In the National Health Interview Survey, we estimated associations using survey-weighted multivariable logistic regression models.

Results: Firefighters employed for 20 or more years (versus <10years) had higher odds of coronary heart disease (CHD) and composite CVD. After controlling for covariates, associations attenuated but remained statistically significant for CHD (OR=7.23, 95% CI:1.65,31.8) but not composite CVD (OR=1.18, 95% CI:0.39,3.60). Marginally significant and higher odds of composite CVD was observed for firefighters employed in large (100-or-more employees) versus small departments (1-24 employees).

Conclusions: Firefighter's already elevated risk of CHD compounds markedly with tenure, particularly after 20 years. Associations were independent of age, sex, private insurance status and body mass index.

Keywords: Cardiovascular Disease; Firefighters; National Health Interview Survey; NHIS; Tenure; Coronary Heart Disease; Compensation; Workforce size

SMART Learning Outcomes

- Describe the prevalence of cardiovascular disease among firefighters in the United States.
- Describe employment, lifestyle and sociodemographic characteristics of firefighters in the United States.
- Recognize how employment factors (e.g., tenure, department size and compensation) may distinctly or equally impact CVD in United States firefighters.

Introduction

Firefighters face a number of occupational health hazards, including heat, smoke, and chemical exposures, as well as shift work and long working hours.^{1,2} Complicating this is the higher physical demands and psychosocial stressors from emergency service operations.¹ Previous research suggests that firefighters are at increased risk of cardiovascular disease (CVD) and CVD-related mortality.^{1,2,3,4} CVD is of significant concern since it impacts quality of life in firefighters and incurs substantial economic, labor, and healthcare costs.^{2,5,6} CVD burden and risk factors have been previously described among international firefighters^{7,8,9,10} and in select firefighting departments within the United States (U.S.).^{11,12,13,14} Documented risk factors include age, lifestyle, and clinical factors such as high cholesterol, obesity, smoking, hypertension, diabetes, and alcohol use.^{15,16,17} Employment factors which vary across occupations and industries,^{18,19} can also protect from or contribute to CVD and CVD-related mortality.^{20,21,22,23,24,25,26} Previous occupational health research suggests a positive relationship of CVD with both tenure and shift work in the general U.S. population and in certain occupational groups.^{24,25,26,27} However, the relationship between CVD and tenure in a representative national sample of U.S. firefighters has not been systematically characterized in previous studies. Whether this relationship is independent of a firefighter's age and other key risk factors for CVD and employment is also unclear. In addition to job tenure, certain organizational factors may also be relevant to CVD prevalence among firefighters. Workforce or department size and compensation type (i.e., salaried or hourly pay), are associated with quality of life, job satisfaction and employee engagement, all of which are associated with downstream impacts on health outcomes including cardiovascular health.^{28,29,30,31}

For instance, differences have been reported in the number of hours worked per week, tenure, compensation and department size for career versus volunteer firefighters.^{32,33} Relatedly, volunteer firefighters were mostly employed in smaller and more rural departments (responding to emergency calls for populations of 25,000 people or less), did not typically receive a salary and approximately 4 of every 7 have been active for less than 10 years.^{32,34} We previously showed evidence suggesting that U.S. law enforcement workers in both small (1-25 employees) and large (more than 500 employees) but not mid-sized departments, those with tenure above 20 years, and those compensated as hourly workers had higher prevalence of CVD after controlling for age and various risk factors.²¹ Whether these employment factors also impact CVD in a national U.S. sample of firefighters has not been systematically explored and remains unclear. Moreover, prior studies of U.S. firefighters have primarily relied on databases from select states and cities, limiting their generalizability to the national firefighter population. To the best of our knowledge, the impact of these employment factors on CVD in a nationally representative sample of U.S. firefighters has not been previously examined. This is critical for informing public health policies and guiding occupational health surveillance efforts, as well as targeted interventions.

Here, we used the National Health Interview Survey (NHIS), a database underutilized in occupational health research. We had two objectives in the present study. First, we sought to describe prevalence of CVD as well as select employment, clinical and sociodemographic characteristics in a national sample of U.S. firefighters between 2006 and 2018. Second, we assessed associations of employment factors including tenure, compensation and workforce size with prevalent CVD among firefighters.

Methods

Study Design and Settings

The NHIS is a volunteer cross-sectional survey of the U.S. population “conducted by the U.S. National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention, Atlanta, GA, USA.”^{35,36} The NHIS captures a broad range of sociodemographic, health, and occupational factors, and is representative of the civilian non-institutionalized population of the U.S.^{35,36} Details of this dataset and survey methodology have been extensively described.^{35,36} Briefly, the NHIS is conducted annually and “employs a multistage stratified cluster probability design which randomly selects one adult per household for interview in English and/or Spanish.”^{35,36} Computer-assisted personal interviews are used to collect information at the respondents’ home or over the telephone. Data from the NHIS is anonymized and publicly available.”^{35,36} For the present analysis, we pooled annual data from the 2006 to 2018 survey cycles. This is because the redesign of the NHIS questionnaire, weighting approach and the COVID-19 pandemic precluded combining survey cycles before 2018 to those from 2019 onwards.³⁷ “Ethical approval for the conduct of the NHIS is maintained by the US Office of Management and Budget (#0920-0214) and the research ethics review board of the NCHS (#2018-01)”. We obtained a claim of exemption for the current study through the University of Illinois Chicago institutional review board (#2023-0688) since the NHIS database is deidentified and publicly available.

Study Population

Figure 1 describes the selection criteria for the present study. A total of 381,989 adults aged 18 years and older participated in the 2006 to 2018 NHIS cycles. The NHIS collected verbal responses on detailed job functions and employer information from participants. Responses were evaluated

by U.S. Census Bureau coding specialists. For occupation and industry, 4-digit codes informed by Standard Occupation Classification (SOC) codes were assigned.^{38,39} Replacement with 2-digit recodes was carried out prior to release of public use files to maintain participant confidentiality.^{38,39} We used 2-digit SOC codes specific to the NHIS to identify participants employed in firefighting and fire prevention. NHIS cycles conducted between 2006 to 2009 used the 2000 SOC codes while the 2010 to 2018 cycles used the 2010 SOC codes. Specifically, participants who identified as being employed in firefighting and fire prevention occupations (n=667) were identified using SOC simple code 12 and detailed code 36 (codes specific to the NHIS survey). We excluded participants employed in firefighting and fire prevention who were missing data on either a CVD outcome, employment factor or covariate of interest (Figure 1). First-line supervisors or managers of protective service workers including those for firefighters were grouped together by NHIS and were also excluded. This resulted in a study population of 616 (unweighted counts) participants employed in firefighting and fire prevention. The present study included both currently employed, retired and disabled firefighters because our goal was to assess the relationship of employment factors with CVD across the continuum of labor force participation. That is, assessing associations regardless of whether firefighters were still actively employed or no longer participating in the labor force. While active and retired firefighters differ by age and length of employment, it is still useful to examine how employment factors impact CVD within both groups. For instance, active employment in firefighting presents ongoing exposure to contaminants which can increase CVD risk, however, physical fitness requirements, health insurance and other benefits associated with work may confer protection.^{1,2} On the other hand, exposure to contaminants and stress from emergency service activities declines with retirement and is related to decreases in CVD risk, however, other factors linked to loss of

employment and aging will increase the risk of CVD.^{1,2}

Cardiovascular Disease

We assessed individual CVD conditions in firefighters based on responses to four different NHIS survey questions. Participants were asked “have you been told by a doctor or other health professional that you had” 1) “angina, also called angina pectoris?” 2) “coronary heart disease (CHD)”, 3) “a heart attack, also called myocardial infarction?”, and 4) “any other kind of heart disease or heart condition.” In the present study, as previously reported,⁴⁰ we defined a composite for all CVD related conditions by aggregating the four individual conditions (angina pectoris, other heart disease, MI or heart attack, and CHD) collected by the NHIS. Composite CVD categorized participants as either reporting no CVD (none of the four conditions) or reporting one or more of the four CVD conditions.

Employment Factors

The present analysis selected employment factors that were consistently measured across the NHIS survey cycles from 2006 to 2018 which included: labor force participation, employee type, workforce size, employee tenure, and compensation type. Briefly, the NHIS defined labor force participation based on responses to the question “what was your employment status in the last week? And what was the main reason for not working in the last week?”³⁵ Labor force participation was then categorized as currently working, not looking for work, disabled, and retired. Employee type or class of worker was derived in response to the question “which of these (local government, private, self-employed, state and federal government employee) best describes your current job or work situation or the job you held most recently or longest?”³⁵ Workforce size or the “number of

employees was defined by NHIS as 1–24 employees, 25–99 employees, 100–499 employees, and 500 or more employees” in response to “how many people work/worked at this location including yourself?”,³⁵ compensation type was assessed by NHIS as whether workers were paid by the hour at their current or most recent job, and tenure was evaluated by NHIS in response to the question “what is the number of years on current or most recent job?”³⁵ Presently, we examined tenure as less than 10 years, 10 to 19 years, and 20 years or more of employment in most recent or current job as previously reported.²¹

Covariates

We included a wide range of confounders which were selected based on a simplified directed acyclic graph (Figure 2) and prior literature, of which details have been described in a previous analysis.²¹ The present study included “age in years (continuous, categorized as less than 60 or 60 years and older), body mass index (BMI [kg/m²], continuous), educational attainment (less than some college degree, some college/associate degree, bachelor’s degree or more), private insurance coverage (yes or no), sex (male or female), self-reported hypertension (yes or no), self-reported diabetes (diabetic/prediabetic or non-diabetic), smoking status (never smoker, former smoker, and current smoker), alcohol consumption status (lifetime abstainer, former infrequent drinker and current drinker), and physical activity (categorized as no or insufficient physical activity if the participant reported engaging in no exercise or reported <150 minutes a week of light to moderate physical activity or <75 minutes a week of vigorous physical activity; and sufficient physical activity if the participant reported > 150 minutes a week of light to moderate physical activity or >75 minutes a week of vigorous physical activity per the Physical Activity Guidelines Advisory Committee Scientific Report).”⁴⁹

Statistical Analyses

We pooled data from the NHIS cycles between 2006 and 2018 in order to increase the analytical sample of the present study and to improve precision of estimates. Also, we constructed “new 13-year weights calculated as one-thirteenth of sample adult weights (WTFA_SA) consistent with data analysis recommendations by the NCHS.”^{35,36} Descriptive analysis was used to examine the distribution of sociodemographic, clinical, lifestyle and employment factors. For continuous variables, we used survey-weighted means [95% CI] and for categorical variables, prevalence estimates [95% CI] and un-weighted counts were reported. Next, survey-weighted logistic regression models were used to estimate associations of employment factors with prevalence odds of CVD among firefighters.²¹ The present study reports crude or unadjusted models and two adjusted models controlling for a handful of confounders. Model 1 adjusted for age, sex, and private insurance status while model 2 adjusted for age, sex, private insurance status and BMI. In selecting confounders, we evaluated whether including physical activity, BMI, alcohol consumption and smoking status changed estimates and standard errors in models and observed only minimum change. We, however, exclude physical activity, alcohol consumption and smoking status to maintain parsimony and to avoid overfitting final models. Also, we conducted a test for model specification using the STATA linktest command (non-significant p-value suggests correct model specification). Test p-values were non-significant for fully adjusted models suggesting adequate model specification.

In addition, we assessed evidence of multicollinearity and correlation between covariates in fully adjusted final models. Tenure (< 10 years, 10 - 19 years or 20+ years) and age (less than 60 years or 60 years and older) were categorized to account for non-linear relationships with CVD.

Correlation between age and tenure was moderate, $r=0.57$. Correlations for other covariates in the final model were weak overall. Assessment of multicollinearity did not demonstrate any evidence based on evaluation of “change in standard errors, variance of inflation (variance of inflation >10 suggests evidence of multicollinearity) and tolerance tests (tolerance value <0.1 suggests evidence of multicollinearity).”⁴¹

Furthermore, the present analysis only evaluated CHD and composite CVD conditions in multivariable models given the limited sample size (number of cases reported for myocardial infarction or heart attack and angina pectoris) which impacted model stability and the precision of model parameter estimates. In sensitivity analysis, we also assessed effect modification by age on the relationship of tenure with CVD. We included product terms to models (age x tenure; $p \leq 0.05$ indicates effect modification), but did not find evidence suggesting that age modified the relationship of tenure with CHD ($p=0.196$) and composite CVD ($p=0.256$). Stata/SE version 18.0 (StataCorp LLC) was used for all statistical analyses.

Results

Sociodemographic, Clinical and Employment Characteristics of Participants

We included 616 firefighters (unweighted counts) in the present analysis (Table 1). The prevalence of CVD in firefighters ranged from 3.1% for angina pectoris to 11.8% for composite CVD (Table 1). Overall, the mean age was 48 years, majority were male (96%), reported private health insurance coverage (83%), were physically active (87%), never smokers (57%) and current drinkers (80%; Table 1). Next, employment characteristics of firefighters are presented in Table 2. The majority of firefighters were participating in the labor force (70%), reported employment in local government departments (79%) and small (1-24 employees) to mid-size (25-99

employees) departments (79%). Average tenure reported by firefighters was 15 years (Table 2).

Employment factors are associated with Cardiovascular Disease

The association of workforce size, tenure and compensation type with CHD as well as composite CVD are shown in Table 3. Broadly, adjusting for covariates including age, sex, private insurance status, and BMI attenuated associations (Table 3). Firefighters who were employed for 20 or more years demonstrated higher prevalence odds of CHD (OR=7.23, 95% CI:1.65, 31.8; Table 3) and non-significant higher prevalence odds of composite CVD (OR=1.18, 95% CI:0.39, 3.60; Table 3) when compared to those employed for less than 10 years. In contrast, those working for 10-19 years demonstrated non-significant lower odds of CHD and marginally significant lower odds of composite CVD (OR=0.38, 95% CI:0.12, 1.15; Table 3). Among firefighters, compensation type (i.e. hourly pay) and moderate to larger fire departments showed higher but non-significant associations with CHD. No associations were observed between compensation type and composite CVD, while higher and marginally significant odds of composite CVD (OR=2.17, 95% CI:0.98, 4.80) was observed for firefighters employed in larger departments (100 or more employees) compared to smaller departments (1-24 employees).

Discussion

In this nationally representative U.S. sample, we described prevalence of CVD and characteristics of workers employed in firefighting and fire prevention. We also assessed associations of select employment factors with CHD and composite CVD (sum of all self-reported CVD outcomes). There were three key findings. First, among firefighters, tenure of 20 years when compared to tenure of 10 years or less was significantly associated with higher prevalence odds of CHD. This

association was independent of age, sex, private insurance status and BMI. Associations with composite CVD followed a similar pattern for tenure of 20 plus years but was not significant in fully adjusted models. Second, the association of workforce or fire department size with CVD was somewhat consistent. We observed higher and non-significant associations of employment in mid-sized to larger departments with CHD, while employment in large departments (100 or more employees) compared to small departments (1-24 employees) showed marginally significant higher odds of composite CVD. Third, compensation type (i.e. whether firefighters were paid by the hour) was not significantly associated with CVD.

Prevalence of CVD and characteristics of firefighters

The prevalence of CHD in firefighters was similar to our previous investigation in law enforcement workers²¹ and another national study of US adults 18 years of age and older.⁴² Prevalence estimates of composite CVD as well as sociodemographic, lifestyle and employment characteristics observed in this national sample of firefighters are also consistent with some previous studies.^{7,11,12,13,14,40} In particular, employment characteristics are in line with a national report of U.S fire departments using data from the National Fire Protection Agency (NFPA) Survey of Fire Departments for US Fire Experience During 2020 and the NFPA Fire Service Survey, 2018 – 2020.³² However, NHIS does not distinguish between fire inspectors, career firefighters and volunteer firefighters, hence, the present study did not examine CVD prevalence, sociodemographic, lifestyle and employment characteristics within these subgroups.

Select employment factors are associated with CVD in firefighters

Firefighters with tenure 20 years or more, , when compared to those employed for less than 10 years had higher odds of CHD. Employment for 10 to 19 years (versus less than 10 years) was associated with lower odds of CVD, but this was not statistically significant. Consistent with our findings of higher CVD in firefighters with tenure of 20 years or more, some previous studies have also observed positive associations of tenure with CVD,^{43,44} including in adjacent emergency services occupations such as law enforcement and military.^{21,45} Observed associations may be linked to chronic job stress and long work hours in firefighters which can alter physiological pathways in the cardiovascular system, thus increasing CVD risk.^{25,27,46} Firefighters may also be exposed to direct risk factors which would be expected to increase their CVD risk and compound impacts of longer tenure including heat exposure, smoke exposure, shift work and sleep deprivation.^{1,2,25,27} Employment also confers protective effects including access to health insurance and economic stability which often contrasts with workplace stress, long work hours and job strain.⁴⁷ However, in the present study, we could not evaluate the impact of workplace stress and hours worked per week since these factors were not consistently assessed by NHIS across survey cycles. Of note, observed higher odds of CVD in our analysis are on top of inclusions of retired and disabled firefighters. This means that observed associations may be impacted by the healthy worker effect since CVD diagnosis could result in retirement or disability, and therefore exclusion from the workforce. Among firefighters, there is also increased likelihood of the healthy hire effect. That is, firefighters have more stringent physical health requirements during the initial selection process for employment which informs burden of risk factors and impacts CVD development over time.^{48,49} Comparing the present findings in firefighters (an overall healthier group) to the general population and other worker groups is therefore likely to underestimate associations of employment factors with CVD.

Presently, we also did not find compensation type (i.e. whether firefighters were paid by the hour) to be associated with CVD. The relationship of compensation type with CVD may operate through various mechanisms which are not fully understood. For instance, research suggests that workers who are paid hourly may endure job insecurity because of the potential for hours and income to vary, which could result in financial stress, and require several jobs and additional hours to preserve financial stability.^{47,50} Hourly workers may also not have access to employment benefits, healthcare and preventive services which can elevate CVD risk.⁴⁷ On the other hand, reductions in working hours have been previously linked to protective mental health and well-being benefits,⁵¹ and hourly work may provide flexibility and pay incentives which can have beneficial downstream impacts on stress and cardiovascular health. Hourly work may also reflect part-time and/or seasonal employment. As previously stated, we could not distinguish between fire inspectors, career fighters and volunteer firefighters since NHIS does not disaggregate these groups. Within the firefighting and fire prevention occupation, there are marked differences in compensation for volunteer versus career firefighters.³² Typically, volunteer firefighters are not salaried, nor do they receive payment for firefighting services.^{32,34} Rather, they may receive reimbursement for expenses and/or benefits including supplies, life insurance, transportation, food and health insurance.³² Disaggregating subgroups in future studies will be critical for providing insights on how compensation impacts CVD among firefighters.

In addition, our findings suggesting higher prevalence of CVD for medium (25-99 employees) and large (100 or more employees) fire departments when compared to small fire departments (1-24 employees) needs further investigation. For instance, the specific factors that may elevate CVD

risk in larger firefighting departments with more resources are not well characterized and may include increases in workplace stress, job strain and demand, and higher rates of shift work. These were not available or uniformly collected across the NHIS cycles and therefore were not assessed in the present study. Given that these factors may mediate or modify the relationship of compensation type and department size with CVD, they should be further evaluated in future studies.

Strengths and limitations

The present study has noteworthy strengths. Pooling 13 years of NHIS data allowed us to increase statistical power and improve the precision of estimates. In U.S. firefighters, we present a national snapshot of employment, clinical and sociodemographic characteristics. We detail associations of some previously understudied employment factors with CVD outcomes in firefighters. The current analysis also aligns with and builds on strategic goals and research priorities of the National Institute of Occupational Safety and Health,⁵² which includes to “identify employment and known risk factors of CVD in firefighters and other public safety workers.” In interpreting our results, however, we also note the following limitations, some of which have been previously described.²¹ The NHIS uses self-report for “physician or healthcare professional diagnoses of CVD outcomes” as well as risk factors.²¹ These may be influenced by participants recall, their access to healthcare services, and whether the participant is knowledgeable about their CVD diagnosis and overall health status. We were further limited by the data on employment and clinical factors measured by the NHIS. For instance, shift work, rates of hourly wage, psychosocial and workplace stress were not uniformly assessed across NHIS cycles.²¹ We also could not distinguish between volunteer and career firefighters, nor could we explore associations within subgroups of disabled and retired

firefighters given limitations in sample size and lack of detailed information on firefighter subgroups. Relatedly, we were limited by sample size for subgroup analysis by age and CVD subphenotypes including angina and MI or heart attack. This should be assessed in future studies. There exists the possibility of residual confounding from unobserved or unmeasured variables, and “the cross-sectional design of NHIS also precludes inference on causality since we cannot determine whether the selected employment factors and covariates preceded the diagnosis of CVD among firefighters.”²¹ Also, we did not have information on age at first employment in firefighting and could not assess how age might approximate tenure in this context. Moreover, age at retirement or the reason for retirement were not collected by the NHIS, thus, we could not investigate how retirement additionally impacts CVD among firefighters. In addition, the NHIS may undercount workers who are actively employed since it is a volunteer survey. Firefighters also have a cardiovascular presumption law, receive annual medical exams and are screened for CVD. This could result in an increased likelihood of CVD diagnoses and may impact observed prevalence estimates, limiting direct comparisons to other worker populations.

Conclusion

In this nationally representative U.S. sample of firefighters, tenure but not department size and hourly compensation were significantly associated with CVD. Improved surveillance of firefighters even after retirement or disability, addressing modifiable employment factors and workplace interventions remain critical for mitigating CVD burden. Additional research that captures nuances related to geographic diversity, age of employment and type of firefighter employment, as well as research that uses a prospective study design is necessary to validate the present findings.

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Figure Legends

Figure 1. Study selection of eligible participants and those included in the analyses of associations between employment factors and prevalent cardiovascular disease in firefighters; NHIS 2006 – 2018 (unweighted counts)

Figure 2. Directed acyclic graph showing associations between employment factors and prevalent cardiovascular disease in firefighters; NHIS 2006 – 2018

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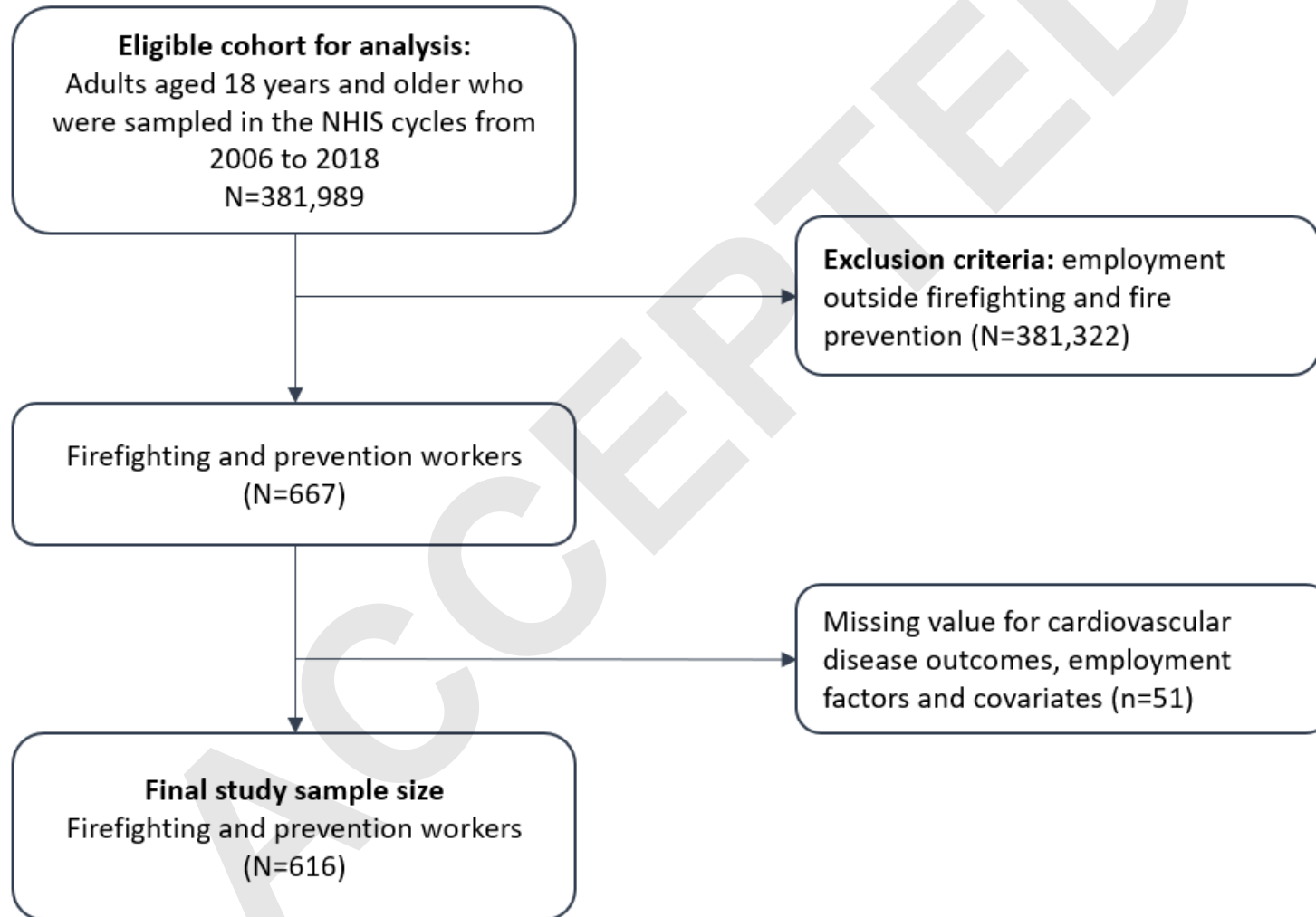
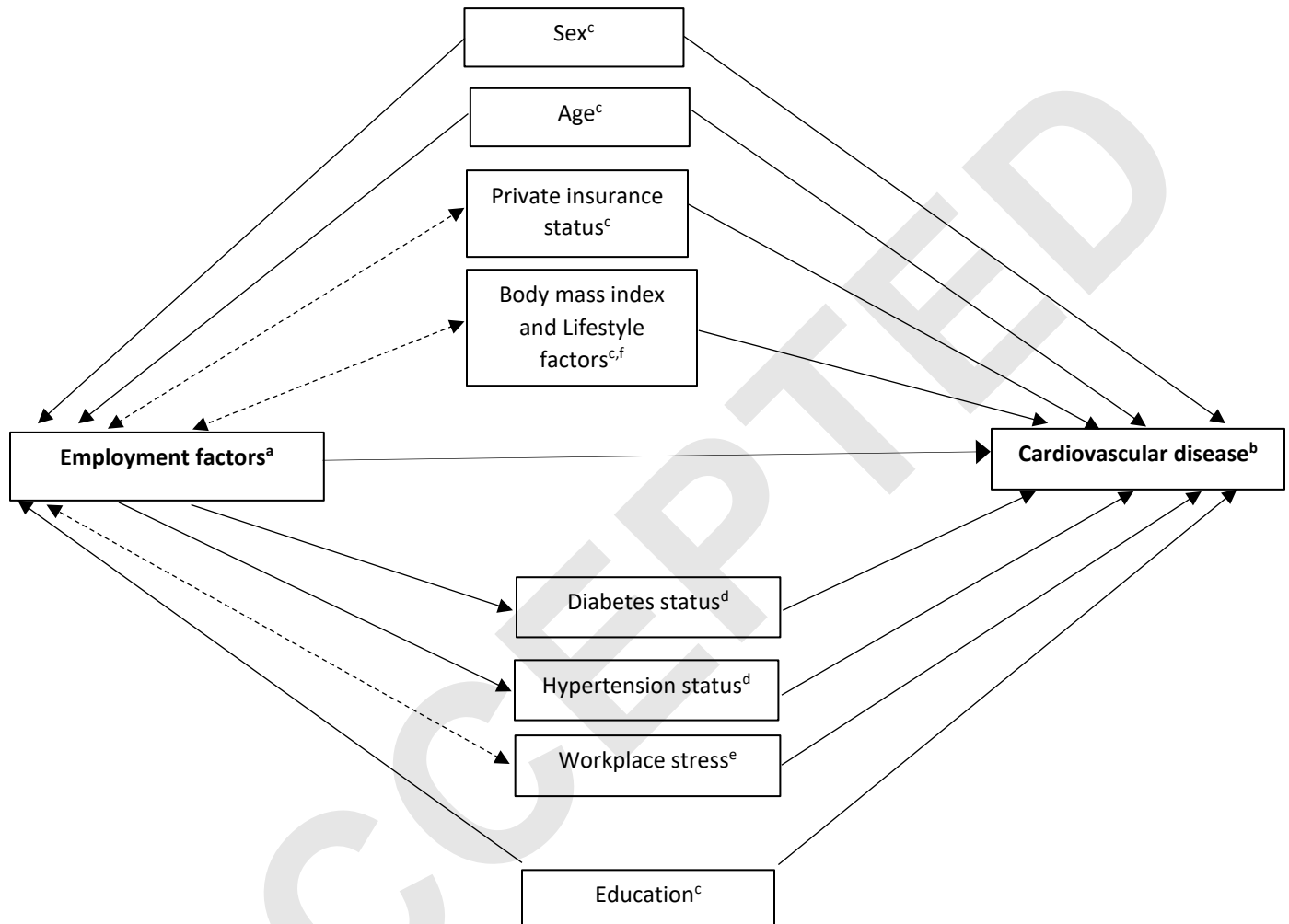


Figure 2. Directed acyclic graph showing associations between employment factors and prevalent cardiovascular disease in firefighters; NHIS 2006 – 2018



^a Employment factors: labor force participation, employer type, number of employees or department size, employee tenure and compensation type (hourly pay).

^b Cardiovascular diseases: self-reported coronary heart disease, angina pectoris, myocardial infarction/heart attack, and other heart disease.

^c *A priori* confounders: age, sex, body mass index, lifestyle factors including smoking, physical activity, and alcohol consumption; and socio-economic status measures (SES) including private insurance coverage and education.

^d Potential mediators include diabetes and hypertension status.

^e Workplace stress is an unobserved variable in the present NHIS analysis.

^f Dotted lines suggest potential bi-directional relationship of covariates with selected employment factors.

Table 1. Prevalence of cardiovascular disease and sample characteristics of United States firefighters: NHIS 2006-2018

	Unweighted counts	Weighted percent
	N=616	[95% CI]
Coronary heart disease	33	5.3 [3.6, 7.7]
Angina pectoris	16	3.1 [1.7, 5.6]
MI or heart attack	27	3.8 [2.4, 6.0]
Other heart disease	40	6.7 [4.7, 9.4]
Composite CVD^a	74	11.8 [9.1, 15.2]
Age [years]; mean [95% CI]	-	47.4 [45.9, 49.0]
Less than 60 years	441	76.1 [72.0, 79.8]
60 years and older	175	23.9 [20.2, 28.0]
Body mass index [kg/m²]; mean [95% CI]	-	28.8 [28.3, 29.3]
Educational attainment		
Less than some college degree	159	26.4 [22.1, 31.2]
Some college/associate degree	354	57.5 [52.7, 62.2]
Bachelor's degree or more	103	16.1 [13.0, 19.7]
Private insurance coverage		
No	116	17.3 [14.0, 21.3]
Yes	500	82.7 [78.7, 86.0]
Sex		
Male	586	95.7 [93.3, 97.2]
Female	30	4.3 [2.8, 6.7]
Hypertension status		
No	414	68.7 [63.9, 73.1]
Yes	202	31.3 [26.9, 36.1]
Diabetes status		
Non-diabetic	554	89.6 [86.2, 92.3]

Diabetic/prediabetic	62	10.4 [7.7, 13.8]
Smoking status		
Never smoker	360	57.3 [52.1, 62.2]
Former smoker	193	34.0 [29.3, 39.0]
Current smoker	63	8.7 [6.3, 12.0]
Physical activity^b		
Active	527	87.1 [83.4, 90.0]
Inactive	89	12.9 [10.0, 16.6]
Alcohol consumption		
Lifetime abstainer	49	7.1 [5.1, 9.8]
Former infrequent drinker	81	12.5 [9.6, 16.1]
Current drinker	486	80.4 [76.4, 83.9]

^a Composite CVD: one or more self-reported CVD vs. no self-reported CVD [sum of coronary heart disease or angina or MI/Heart Attack or other heart disease].

^b Physical activity defined as inactive [no exercise/<150 minutes light-to-moderate/<75 minutes vigorous physical activity and active [$\geq$ 150 minutes light-to-moderate/ $\geq$ 75 minutes vigorous physical activity].

Table 2. Selected employment factors among United States firefighters: NHIS 2006-2018

Characteristics	Unweighted counts N=616	Weighted percent [95% CI]
Labor force participation		
Yes	421	70.9 [66.6, 74.9]
No	195	29.1 [25.1, 33.4]
Employee type		
Private or self-employed	39	5.7 [3.9, 8.3]
Federal or state government	120	15.6 [12.7, 19.1]
Local government	457	78.6 [74.7, 82.1]
Workforce size [number of employees]		
1-24 employees	287	48.3 [43.6, 53.0]
25-99 employees	195	31.5 [27.4, 36.0]
100 employees or more	134	20.2 [16.8, 24.1]
Employee tenure; mean [95% CI]		
< 10 years	-	15.1 [14.1, 16.1]
10 - 19 years	217	37.5 [32.8, 42.4]
20+ years	156	24.4 [20.5, 28.9]
Compensation type [paid by the hour]		
Yes	243	38.1 [33.7, 42.6]
No	330	53.1 [48.3, 57.9]
	286	46.9 [42.1, 51.7]

Table 3. Multivariable models evaluating associations between employment factors and prevalent coronary heart disease and composite CVD in United States firefighters: NHIS 2006-2018

Employment factors	Coronary heart disease	Composite CVD ^a
	OR [95% CI]	OR [95% CI]
	n=33/616 [unweighted]	n=74/616 [unweighted]
Crude models		
Workforce size [number of employees]		
25-99 employees vs 1-24 employees	1.17 [0.45,3.02]	0.93 [0.49,1.76]
100 or more vs 1-24 employees	0.97 [0.33,2.85]	1.78 [0.84,3.79]
Employee tenure in years		
10 - 19 vs < 10 years	0.30 [0.04, 2.43]	0.38 [0.12, 1.21]
20+ vs < 10 years	12.6 [2.35, 68.0]**	3.06 [1.47, 6.40]**
Compensation type [paid by the hour]		
Yes vs no	0.73 [0.32, 1.67]	0.62 [0.34, 1.13]
Adjusted model 1^b		
Workforce size [number of employees]		
25-99 employees vs 1-24 employees	1.48 [0.54,4.04]	1.10 [0.56,2.17]
100 or more vs 1-24 employees	1.11 [0.38,3.27]	2.17 [0.98,4.80]*
Employee tenure in years		
10 - 19 vs < 10 years	0.31 [0.04, 2.29]	0.37 [0.12, 1.14]*
20+ vs < 10 years	6.12 [1.07, 34.9]**	1.14 [0.38, 3.37]
Compensation type [paid by the hour]		
Yes vs no	1.27 [0.55, 2.92]	0.90 [0.47, 1.74]
Adjusted model 2^c		

Workforce size [number of employees]		
25-99 employees vs 1-24 employees	1.40 [0.53,3.67]	1.08 [0.55,2.14]
100 or more vs 1-24 employees	1.14 [0.38,3.44]	2.17 [0.97,4.82]*
Employee tenure in years		
10 - 19 vs < 10 years	0.34 [0.05, 2.13]	0.38 [0.12, 1.15]*
20+ vs < 10 years	7.23 [1.65, 31.8]**	1.18 [0.39, 3.60]
Compensation type [paid by the hour]		
Yes vs no	1.30 [0.56, 3.01]	0.91 [0.47, 1.78]

^a Composite CVD: [one or more self-reported CVD outcome [sum of coronary heart disease or angina or MI/Heart Attack or other heart disease] vs no self-reported CVD outcome].

^b Models adjusted for age, sex, and private insurance status.

^c Models adjusted for age, sex, private insurance status, and body mass index.

**p<0.05; * p <0.10

Visual Abstract

